A Semi-Automated Approach for Detecting and Locating Swine Animal Feeding Operations over Regional Areas

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Surface runoff from animal feeding operations (AFOs) and its infiltration into ground water can pose a number of risks to water quality mainly because of the amount of animal manure and waste water they produce. Excess nutrients generated by livestock facilities can lead to algal blooms and anoxic water conditions, shellfish bed contamination, loss of water recreation activities, and possibly fish kills and human health dangers.

Developing a cost-effective approach for locating and studying existing AFOs over a broad regional area is a first step to determining the spatial relationships between these facilities and water quality. A system that is capable of identifying and inventorying existing facilities and determining their geographic location and distribution with regard to other landscape features, such as drainage, geology, soils, slope, and vegetation, should provide important insight for assisting farmers and planners in reducing the environmental risks associated with existing and future animal feeding operations, respectively.

Our research focused on the use of a Geographic Information System (GIS) and high spatial resolution IKONOS satellite data for semi-automatically detecting animal feeding operations in an area of Duplin County, NC. Our results show that single-date, high-resolution, satellite remote-sensing data (IKONOS 4-meter, multi-spectral data) combined with GIS-based semi-automated image processing and geometric analysis of swine AFO features and geography can yield overall detection accuracies of 76% for hog barns and 79% for lagoons.

Our study area is a portion of Duplin County, NC. The county has experienced problems of excessive nutrients in its waterways and, of the 1,359 farms in the county (based on the 1992 Census of Agriculture survey), nearly one-quarter (338) raise hogs or pigs. In total, more than one million hogs and pigs are raised in Duplin County annually.